

Claims

[1] A powder of a layered lithium-nickel-manganese-cobalt composite oxide which is for use as a positive-electrode material for lithium secondary battery, characterized by having a composition represented by the following formula (I), having a volume resistivity of $5 \times 10^5 \Omega \cdot \text{cm}$ or lower in the state of being compacted at a pressure of 40 MPa, and having a value of C/S, wherein C is the concentration of carbon contained therein (% by weight) and S is the BET specific surface area thereof (m^2/g), of 0.025 or smaller:



(wherein $0 < z \leq 0.91$, $0.1 \leq x \leq 0.55$, $0.20 \leq y \leq 0.90$, $0.50 \leq x+y \leq 1$, and $1.9 \leq \delta \leq 3$).

[2] A powder of a layered lithium-nickel-manganese-cobalt composite oxide which is for use as a positive-electrode material for lithium secondary battery, characterized by having a composition represented by the following formula (II), having a volume resistivity of $5 \times 10^5 \Omega \cdot \text{cm}$ or lower in the state of being compacted at a pressure of 40 MPa, and having a value of C/S, wherein C

is the concentration of carbon contained therein (% by weight) and S is the BET specific surface area thereof (m^2/g), of 0.025 or smaller:



(wherein $0 < z \leq 0.15$, $0.20 \leq x \leq 0.55$, $0.20 \leq y \leq 0.55$, and $0.50 \leq x+y \leq 1$).

[3] The powder of a layered lithium-nickel-manganese-cobalt composite oxide for use as a positive-electrode material for lithium secondary battery according to claim 1 or 2, wherein in formula (I) and formula (II), the value of y/x , which indicates Mn/Ni atomic proportion, is $0.95 \leq y/x \leq 2.5$.

[4] The powder of a layered lithium-nickel-manganese-cobalt composite oxide for use as a positive-electrode material for lithium secondary battery according to claims 1 to 3, wherein the concentration of carbon contained therein, C, is 0.025% by weight or lower.

[5] The powder of a layered lithium-nickel-manganese-cobalt composite oxide for use as a positive-electrode material for lithium secondary battery according to claims

1 to 4, which has a bulk density of 1.5 g/cc or higher, an average primary-particle diameter B of 0.1-3 μm , and a secondary-particle median diameter A in the range of 3-20 μm .

[6] The powder of a layered lithium-nickel-manganese-cobalt composite oxide for use as a positive-electrode material for lithium secondary battery according to any one of claims 1 to 5, which has a BET specific surface area of 0.2-2.5 m^2/g .

[7] A process for producing the powder of a layered lithium-nickel-manganese-cobalt composite oxide for use as a positive-electrode material for lithium secondary battery according to any one of claims 1 to 6, which comprises pulverizing at least one nickel compound, at least one manganese compound, and at least one cobalt compound in a liquid medium to an average particle diameter of 0.3 μm or smaller to prepare a slurry containing the compounds evenly dispersed therein, spray-drying the slurry to obtain a powder composed of secondary particles formed by the aggregation of primary particles, subsequently sufficiently mixing the powder with at least one lithium compound, and calcining the resultant mixture in an oxygenic gas atmosphere.

[8] A positive electrode for lithium secondary battery, which comprises a current collector having thereon a positive-electrode active-material layer which comprises the powder of a layered lithium-nickel-manganese-cobalt composite oxide for use as a positive-electrode material for lithium secondary battery according to any one of claims 1 to 6, and a binder.

[9] A lithium secondary battery comprising a negative electrode capable of intercalating/deintercalating lithium, a nonaqueous electrolyte containing a lithium salt, and a positive electrode capable of intercalating/deintercalating lithium, wherein the positive electrode employed is the positive electrode for lithium secondary battery according to claim 8.